REMARKS

Claims 1-11, 17, 18, and 20-35 are pending, with claims 1-4 being independent. Claims 1-4 have been amended. Support for the amendments can be found in the originally-filed specification, at least at page 9, lines 5-22. No new matter has been introduced.

Claims 1-4, 9-11, 20-27, and 32-35 have been rejected as being unpatentable over U.S. Patent No. 4,646,424 (Parks) in view of U.S. Patent No. 6,009,888 (Ye) and U.S. Patent No. 5,252,427 (Bauer). Applicant requests withdrawal of the rejection of claims 1, 3, 10, 20, 22, 24, 26, 32, and 34 because neither Parks, Ye, Bauer, nor any proper combination of the three describes or suggests removing a resist pattern by using a resist stripper which dissolves and removes the resist pattern after irradiating the resist pattern, as recited in claims 1 and 3, and because it would not have been obvious to modify Parks in the manner set forth in the rejection.

In Parks, after a wafer is cleaned and coated with a layer of titanium, the wafer is plasma etched to remove titanium present beneath an exposed resist pattern. See Parks at col. 6, lines 3-39. Next, the substrate is "plasma ashed in an oxygen atmosphere to remove the remaining photoresist material." See Parks at col. 6, lines 39-59. Thus, the photoresist material in Parks is removed by an ashing method. There is nothing in Parks that would suggest that such photoresist material is removed using a "resist stripper which dissolves and removes the resist pattern," as recited in claims 1 and 3.

The Examiner points to col. 6, lines 58-60 of Parks to somehow show such a resist stripper and argues that this passage indicates that remaining resist is stripped and that "[s]tripping of the resist is accomplished by using a resist stripper." However, this passage in Parks merely explains that the remaining resist material is stripped from the substrate (presumably using the ashing method detailed in other sections of Parks) and Parks does not indicate that the resist material is removed using a resist stripper. Rather, Parks explains in the passages at col. 3, lines 5-8 and col. 6, lines 44-48 that the remaining resist material is removed using a plasma ashing method: "the resulting substrate … is then plasma ashed in an oxygen atmosphere to remove the remaining photoresist material." Plasma ashing as described in Parks is very different from removal using a resist stripper, which dissolves and removes a resist

pattern, as recited in claims 1 and 3. In particular, while plasma ashing removes the resist pattern, plasma ashing does not dissolve the resist pattern.

Furthermore, Parks never describes or suggests that the photoresist material is removed after a resist pattern is irradiated, as also recited in claims 1 and 3. Rather, Parks performs the removal of the photoresist after the wafer is plasma etched. See Parks at col. 6, lines 3-59.

Moreover, Ye does not remedy the failure of Parks to describe or suggest this subject matter. In Ye, the photoresist pattern 28 is not removed using a resist stripper. Rather, in Ye, the photoresist pattern 28 is removed with a combination of a UV laser 111 and an acid bath. See Ye at col. 6, lines 32-34 and col. 6, line 62 to col. 7, line 3.

Additionally, Ye's removal of the photoresist pattern 28 is not performed after irradiation of Ye's photoresist pattern 28. Rather, the removal of Ye's photoresist pattern 28 is performed concurrently with or prior to irradiation of Ye's photoresist pattern 28. As Ye explains, "the photoresist pattern 28 and polymer layer 30 are immersed in a wet bath 34 … and then the wafer, polymer and photoresist are irradiated 36 with UV light, preferably from a UV laser." See Ye at col. 5, lines 43-49 and Fig. 3.

The Examiner points to col. 7, lines 18-36 of Ye to somehow suggest that Ye teaches irradiating a residue followed by removal. This passage of Ye explains that the wafer 10 is "immersed in an acid bath 34" and "while still immersed in bath 34 is irradiated with UV light 56, preferably from a UV laser." Ye also explains that the wet bath removes the polymer and photoresist polymers because the acid is a "strong oxidant that facilitates the decomposition of the polymers." See Ye at col. 6, lines 49-65. Therefore, the residual photoresist and polymer are dissolved by the wet bath prior to irradiation of the UV light. Moreover, even if the residues are not removed when the wafer is first immersed (which applicant does not concede), the residues are removed at least at the moment that the UV light is directed to the bath 34, and therefore the residues may be removed concurrently with irradiation. But, Ye never suggests that the removal would be after the irradiation with the UV light.

Thus, even if one were to modify Parks with Ye's removal method, Parks would still fail to describe or suggest removal of a resist pattern using a resist stripper after irradiating the resist pattern.

Additionally, Bauer does not remedy the failure of Parks to describe or suggest removing a resist pattern by using a resist stripper which dissolves and removes the resist pattern after irradiating the resist pattern, as recited in claims 1 and 3. Bauer relates to a photoresist composition containing a polymeric material and a substance that forms an acid upon exposure to actinic radiation. See Bauer at Abstract and col. 2, line 58 to col. 3, line 4. The photoresist can be used to prepare printed circuits by applying a layer of the photoresist to a surface of the substrate. See Bauer at Abstract and col. 3, lines 5-10. The photoresist layer is exposed to actinic radiation to form exposed image areas in the photoresist layer. See Bauer at col. 3, lines 21-23. Then, the exposed areas of the photoresist layer are removed with a developer solution to uncover substrate surface areas, and the uncovered substrate surface areas are either etched or plated with another metal. See Bauer at col. 3, lines 23-29. The unexposed resist is removed by "a stripping process involving re-exposure to actinic radiation followed by a second development operation to form the circuit board directly." See Bauer at col. 6, lines 54-63. Alternatively, the unexposed resist is removed from the unplated copper surface, "which is then etched or removed from the substrate to form a plated printed circuit board." See Bauer at col. 6, lines 63-66.

Thus, the first irradiation of the photoresist layer occurs prior to any etching. And, while the second irradiation of the photoresist layer occurs after the etching of the uncovered substrate surface areas, the photoresist layer is not then removed after irradiation using a resist stripper that dissolves and removes the photoresist. Rather, the photoresist layer is removed due to the re-exposure to the radiation. See Bauer at col. 6, lines 60-62.

Additionally, there is nothing in the cited art that would have motivated one of skill in the art to modify Parks to provide for such irradiation or to provide for removal of a resist pattern using a resist stripper after irradiating the resist pattern. Any such modification of Parks would change the principle of operation of Parks, which merely uses plasma ashing to remove a resist

and never suggests irradiating the resist prior to removal of the resist. See Parks at col. 2, line 58 to col. 3, line 8.

The Examiner points to col. 4, lines 33 and 34 of Ye to somehow provide such motivation. This passage explains that the wet bath/UV laser photoresist removal effect is "superior to conventional photoresist strip processes at removing polymers over photoresist layers." However, Parks' method would not obtain such a benefit since Parks provides no indication that polymers over the resist layer are to be removed.

For at least these reasons, claims 1 and 3 are allowable over any proper combination of Parks, Ye, and Bauer. Claims 10, 20, 22, 24, 26, 32, and 34 are allowable for at least the reasons that claims 1 and 3 are allowable.

Applicant requests withdrawal of the rejection of claims 2, 4, 9, 11, 21, 23, 25, 27, 33, and 35 because neither Parks, Ye, Bauer, nor any proper combination of the three describes or suggests removing a residue of a resist pattern by using a developer that dissolves and removes the residue of the resist pattern after irradiating the residue of the resist pattern, as recited in claims 2 and 4, and because one of ordinary skill in the art would not have been motivated to modify Parks in the manner set forth in the rejection.

There is nothing in Parks that suggests that the photoresist material is removed using a "developer," as recited in claims 2 and 4. Rather, as discussed above, Parks explains that the photoresist material is removed using a plasma ashing method in an oxygen atmosphere. See Parks at col. 6, lines 44-47. Additionally, Parks never describes or suggests that the photoresist material is removed after a resist pattern is irradiated, as also recited in claims 2 and 4, since Parks does not describe irradiation of a residue of a resist pattern with a light.

Moreover, while Ye mentions that a UV laser in combination with an acid bath is used to remove the photoresist pattern 28, Ye fails to describe or suggest that the photoresist pattern and the residue of the resist pattern are removed using a developer after the UV laser irradiates a residue of the photoresist pattern 28.

Realizing these deficiencies in Parks and Ye, the Examiner cites Bauer, and argues that Bauer discloses at col. 6, lines 54-68 that the remains of a resist pattern are "further irradiated and removed using a developer."

In Bauer, as discussed above, a layer of the photoresist is applied to a surface of the substrate, the photoresist layer is exposed to actinic radiation to form exposed image areas in the photoresist layer, the exposed areas of the photoresist layer are removed with a developer solution to uncover substrate surface areas, and the uncovered substrate surface areas are etched or plated. See Bauer at col. 2, line 58 to col. 3, line 29 and col. 6, lines 38-50.

In the instance where a developer is used to remove unexposed resist, this use of developer occurs before the etching process: "[i]n the first instance, the unexposed resist is typically removed from the remaining copper surface by a stropping process involving re-exposure to actinic radiation followed by a second development operation to form the circuit board directly." See Bauer at col. 6, lines 54-63. Therefore, the second development occurs after the first development and before etching. Bauer also provides an example of this process at Example 3, where resist remaining on a plated board is "re-exposed to UV radiation … and the resist removed in the 1% Na_2CO_2 developer solution" and the "uncovered copper substrate areas which are not protected by tin/lead plating are removed by etching." See Bauer at col. 9, lines 39-54. Thus, if one were to modify Parks using the second developer of Bauer, one would still fail to obtain the step of removal of a residue of a resist pattern using a developer, after irradiation of the residue of the resist pattern, after removal of the resist pattern, and after etching of a metal film, as recited in claims 2 and 4.

Additionally, it would not have been obvious to modify Parks to provide for removal of a residue of a resist pattern using a developer because any such modification of Parks would change the principle of operation of Parks, which merely uses plasma ashing to remove a resist and never suggests irradiating the resist prior to removal of the resist. See Parks at col. 2, line 58 to col. 3, line 8. Moreover, Bauer's use of the developer occurs during a step that precedes an etching, while Parks removal of the residue of the resist pattern occurs after an etching. Thus,

one of skill in the art would not be directed to use a developer, as merely mentioned by Bauer in another step in a different process, to remove the residue of a resist pattern in Parks.

For at least these reasons, claims 2 and 4 are allowable over Parks and Ye. Claims 9, 11, 21, 23, 25, 27, 33, and 35 depend from claims 2 and 4, and are allowable for at least the reasons that claims 2 and 4 are allowable.

Claims 5-8 have been rejected as being unpatentable over Parks in view of Ye, Bauer, and U.S. Patent No. 6,645,851 (Ho). Claims 5-8 depend, respectively, from claims 1-4, which were rejected as being unpatentable over Parks in view of Ye and Bauer. Ho does not remedy the failure of Parks, Ye, and Bauer to describe or suggest the subject matter of claims 1-4. In Ho, a photoresist layer 14 is "blanket exposed without a patterned mask and is then developed in an aqueous base solution to remove all photoresist 14 above dielectric layer 12." However, Ho never describes or suggests irradiating a resist pattern, as recited in claims 1 and 3, or irradiating a residue of a resist pattern, as recited in claims 2 and 4, and, therefore, Ho also never describes removal of such resist pattern after irradiating. For at least these reasons, claims 1-4, and dependent claims 5-8, are allowable over any proper combination of Parks, Ye, and Ho.

Claims 17 and 18 have been rejected as being unpatentable over Parks in view of Ye, Bauer, and U.S. Patent No. 4,816,115 (Hörner). Claims 17 and 18 depend, respectively, from claims 3 and 4, which were rejected as being unpatentable over Parks in view of Ye and Bauer. Hörner does not remedy the failure of Parks, Ye, and Bauer to describe or suggest the subject matter of claims 3 and 4. In Hörner, while a photoresist layer 9 is exposed with radiation, as described at col. 7, lines 30-52, there is no description of irradiation of a resist pattern, as recited in claim 3, or irradiation of a residue of a resist pattern, as recited in claim 4. Therefore, there is no description of removal of such a resist pattern or residue after such irradiation. For at least these reasons, claims 3 and 4, and dependent claims 17 and 18, are allowable over any proper combination of Parks, Ye, Bauer, and Hörner.

Claims 28-31 have been rejected as being unpatentable over Parks in view of Ye, Bauer, and U.S. Patent No. 4,673,808 (Katohno). Claims 28-31 depend from claims 1-4, which were rejected as being unpatentable over Parks in view of Ye and Bauer. Katohno does not remedy

the failure of Parks, Ye, and Bauer to describe or suggest the subject matter of claims 1-4. In Katohno, while a resist is stripped, there is no suggestion that the resist or a residue of such resist is stripped after irradiating a resist pattern (or residue of a resist pattern). See Katohno at col. 5, lines 4-30. Accordingly, claims 1-4 and dependent claims 28-31 are allowable over any proper combination of Parks, Ye, Bauer and Katohno.

In conclusion, applicant submits that all claims are in condition for allowance.

The fee in the amount of $120 in payment of the one-month extension of time fee is being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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/Diana DiBerardino/
Diana DiBerardino
Reg. No. 45,653

Fish & Richardson P.C.
1425 K Street, N.W.
11th Floor
Washington, DC 20005-3500
Telephone: (202) 783-5070
Facsimile: (202) 783-2331

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